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May 28, 1996

VIA HAND DELIVERY

Mr. William F. Caton
Acting Secretary
Federal Communications Commission
Washington, D.C. 20554

Re: ET Docket 94-124

DOCKET FILE COPY ORIGINAL

Dear Mr. Caton:

Pursuant to Sections 1.415 and 1.419 of the Commission's Rules, enclosed are an original and 9 copies of Comments to be filed with the FCC's Office of the Secretary by General Motors Corporation on its own behalf and on behalf of one of its subsidiaries, Hughes Electronics Corporation, in response to the Second Notice of Proposed Rulemaking in the above-referenced docket. Also enclosed is a Confirmation Copy. Please date-stamp and return to the messenger.

Sincerely,

Erika Z. Jones

Erika Z. Jones

cc: Lois Williams
Nick Morenc

Enclosures

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FEDERAL COMMUNICATIONS COMMISSION
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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

COMMENTS OF

GENERAL MOTORS CORPORATION
and
HUGHES ELECTRONICS CORPORATION

In the Matter of
ET Docket 94-124

SECOND NOTICE OF PROPOSED RULE MAKING

INTRODUCTION and SUMMARY

General Motors Corporation respectfully submits these comments on its own behalf and on behalf of one of its subsidiaries, Hughes Electronics Corporation, in response to the Second Notice of Proposed Rule Making ("NPRM") in FCC ET Docket 94-124. The Second NPRM (FCC 95-499) was adopted and released on December 15, 1995 and a request for public comments on the proposal was published in the Federal Register on March 29, 1996 (61 Fed. Reg. 14041).

In these comments, GM supports the Commission's proposal to limit temporarily the use of the 76-77 GHz band to vehicle radar systems and to upgrade the status of Amateur Radio Service operators from secondary to co-primary with Government and non-Government Radiolocation Services in the 77.5-78 GHz band. GM also strongly supports the FCC proposal to limit emissions above the 200 GHz band to 1000 picoWatts/cm squared (1000 pW/cm^2).

TEMPORARY RESTRICTION OF THE 76-77 GHz BAND TO VEHICLE RADAR SYSTEMS

The FCC has proposed to limit the 76-77 GHz band to vehicle radar systems, on a temporary basis. (See 2d NPRM ¶61-62.) Currently, Amateur Radio Service operators are authorized to use the 76-77 GHz band. In the Second NPRM, the FCC expressed concern about the need to protect vehicle radar systems from potential interference by restricting use of the 76-77 GHz band to such systems until sharing criteria can be established.

GM supports the proposed FCC rule to limit the 76-77 GHz band to vehicle radar operation at this time. Although it may be possible to share this spectrum in the future, the FCC is correct to restrict the band until sharing criteria can be determined, in order to minimize the risk of potential interference to the operations of the vehicle radar systems.

GM also supports the FCC's companion proposal to upgrade the Amateur Radio Service status in the 77.5-78 GHz band from secondary to co-primary with the Government and non-Government Radiolocation Services. GM believes that adoption of this proposal would assure amateur operators' access to spectrum near 77 GHz, in order to foster amateur experimentation with millimeter wave technology, without introducing the potential risk of interference to vehicle radar systems using the neighboring frequencies.

EMISSIONS ABOVE 200 GHz

GM strongly supports the Commission's proposal to limit emissions in the 200-231 GHz band to 1000 picoWatts/cm squared (1000 pW/cm^2). (See 2d NPRM ¶65.)

During the rulemaking proceeding that led to the First Report and Order, concerns were raised about potential interference from vehicle radar systems to radio astronomy bands. When GM became aware of these concerns, the company spent substantial time working with representatives for the radio astronomers to understand the potential interference problem and to develop a solution. Although GM's initial comments raised concerns about the practicability of measuring and verifying strict out-of-band emission limits for consumer electronics products, GM was nonetheless interested in supporting a compromise solution that would address the concerns of the radio astronomy community. The 2d NPRM states that the NTIA recommended a 1000 pW/cm^2 limit "to prevent interference to radio astronomy operations in the 217-231 GHz band." (See 2d NPRM at ¶65.) GM supports this proposal as an acceptable compromise.

During its evaluation of the feasibility and practicability of out-of-band emission limits above 200 GHz, GM contacted multiple test equipment suppliers and determined that there is no commercially available equipment that is capable of measuring the proposed limits at this time. Commercial test facilities that specialize in making

measurements to FCC requirements and several research universities were also approached, and reported that they were unable to make the requested measurements. The National Institute of Standards and Technology in Boulder, Colorado was contacted, and the staff reported that they are not equipped to make measurements at 231 GHz. Discussions with Andrew Clegg of the Naval Research Laboratory indicated that two National Radio Astronomy Observatories were capable of making tests on radar emissions at 231 GHz. GM elected to measure a prototype transceiver/antenna assembly at the Kitt Peak National Radio Astronomy Observatory in Tucson, AZ, in order to learn about the measurement technique and to attempt to determine the actual third harmonic emission levels. Two different engineering models of a radar transceiver antenna assembly were taken to the Kitt Peak Observatory for measurement. Detailed measurements were taken on the unit that is closest to meeting the intended application in terms of both cost and performance. Cursory measurements taken on the second design indicated significantly lower emissions; however, this design did not meet performance requirements at the fundamental frequency, and it has since been determined that this version cannot meet performance and cost objectives in the future. All work on this alternative design has been discontinued.

The tests were performed in the laboratory in which an 8-beam helium cooled receiver is available. Two measurement

techniques were used. For both measurements, the radar was positioned 80 inches from the 8-beam receiver focal plane, and the radar was rotated to find the peak emission. The emissions were reflected into one channel of the 8-beam receiver.

The test results on this unit varied greatly. One technique yielded a result of less than 2 pW/cm^2, and the other yielded a result between 600-1100 pW/cm^2. The personnel at the National Radio Astronomy Observatory and GM agreed that more tests would be needed to determine which test method more accurately measured the actual emissions. Tests performed on an antenna structure using the same technology and construction as the antenna tested at Kitt Peak but designed to operate at 12 GHz (where accurate and repeatable measurements can be made), gave results that supported the 600 - 1100 pW/cm^2 result obtained at Kitt Peak.

One conclusion that can be reached as a result of this activity is that it is extremely difficult to make repeatable emission level measurements at 231 GHz, even when using the most sophisticated equipment available.

GM also worked with National Radio Astronomy Observatory representatives to determine the probability of interference from third harmonic emissions of 1000 pW/cm^2. Initial calculations showed that a coordination zone of 2 km around the observatory would be required to prevent

interference from vehicular radars. Observatories currently have a coordination zone of 1 km to prevent interference due to spark plug emissions. These calculations assume that the vehicular radar peak emission couples directly into the 0 dB sidelobe of the observatory antenna. The Kitt Peak measurements indicate that while the vehicular radar antenna response at the third harmonic is not nearly as directive as at the fundamental, it is also not uniform, and there are measurable peaks and nulls. Also, many observatories are located at high altitude remote locations, where the vehicular density is very low, and where propagation is often obscured by the terrain. At high altitudes the atmospheric losses are less, and a coordination zone of up to 4 km may be needed at these sites.

Although the interference calculations described above were based on emissions from a single vehicle, the risk of interference to radio astronomy observatories may not increase significantly when numerous vehicles are equipped with vehicle radar systems. As discussed above, the emissions are not uniform, and they could be blocked by terrain. Furthermore, to the extent that the emissions do not couple directly into the observatory antenna sidelobe, the potential for interference is substantially reduced.

While the FCC is correct to take into account the possibility of interference to valid scientific activities, GM believes it is inappropriate to set standards that cannot

be verified at existing commercial test facilities, cannot be measured by existing commercial test equipment, or cannot be measured at NIST or at the FCC. The proposed standard of 1000 pW/cm², while still being difficult to measure, is closer to the capabilities of existing equipment, and is closer to actual levels expected based on extrapolation of measurements made at lower frequencies. The proposed standard is also nearly compatible with existing coordination zones that are currently imposed at observatories. Any substantially stricter out-of-band emission limits would most probably require the use of waveguide filters, which would substantially increase the cost of the vehicle radar systems. Furthermore, substantially stricter limits could delay (or interrupt) the availability of vehicular radar systems in the market, because systems would have to be redesigned to attempt to comply with such limits.

The Commission also solicited comments on whether it might be possible, instead, to allow vehicle radar manufacturers to avoid the need for regulatory out-of-band emission limits by demonstrating, in collaboration with NTIA and radio astronomy users, that there would be a low probability of intereference because of the angular distribution of the vehicle radar systems and the susceptibility of radio astronomy equipment to off-asix signals. (See 2d NPRM at ¶65.) GM is willing to work with

NTIA and the radio astronomers to establish that vehicle radar equipment can be designed to assure that out-of-band emissions levels can be low enough to eliminate the need for the regulations. Such an alternative would solve the identified problems relating to the difficulty of obtaining repeatable measurements for certification purposes.

CONCLUSION

GM supports the FCC's continued efforts to encourage the commercial development of millimeter wave vehicular radar systems, which have the potential to enhance motor vehicle safety. For this reason, GM supports the FCC's proposal to limit the 76-77 GHz band to vehicle radar systems, at least temporarily, until sharing criteria can be established. GM also strongly supports the proposal to establish out-of-band emissions limits above 200 GHz that are no more stringent than the proposed limit of 1000 pW/cm^2. As an alternative to regulation, GM is willing to work with NTIA and the radio astronomers to avoid the need for rules establishing out-of-band limits by demonstrating

that there would be a low probability of interference from vehicle radar systems.

Respectfully submitted,

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and
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May 29, 1996

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